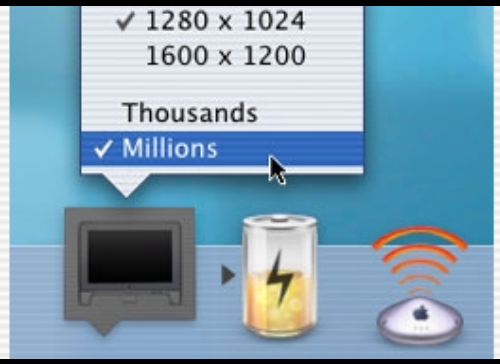
Session 101

Frameworks Overview



Scott Forstall
Director, Application Frameworks

Aqua

Frameworks

Graphics

Darwin

Aqua

Frameworks

Graphics

Darwin

Killer Frameworks
Enable Killer Apps

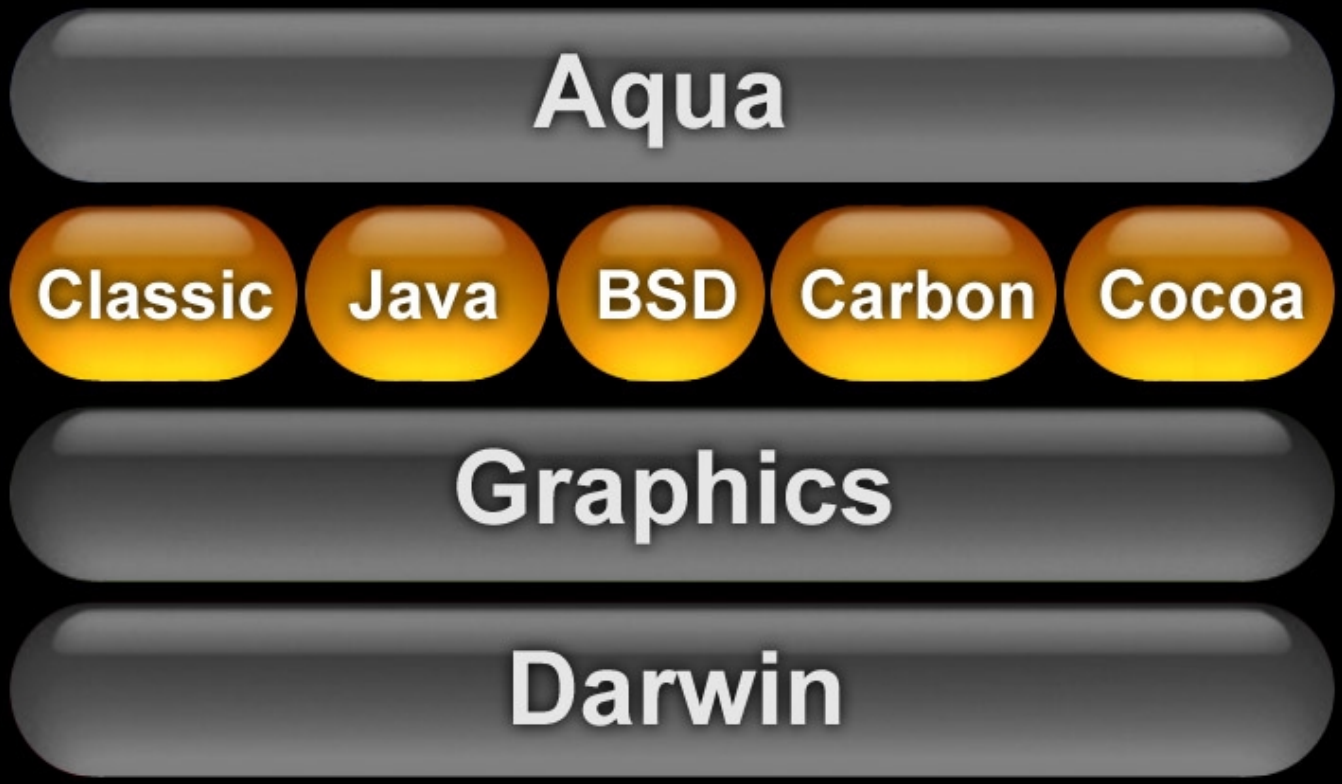
How can I write or bring a killer app to Mac OS X?

Aqua

Frameworks

Graphics

Darwin


Aqua
Classic
Java
BSD
Carbon
Cocoa
Graphics
Darwin

Aqua
Classic
Java
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Cocoa
Graphics
Darwin

Mac OS 9
Apps Just Run

Aqua
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Java
BSD
Carbon
Cocoa
Graphics
Darwin

Aqua
Classic
Java
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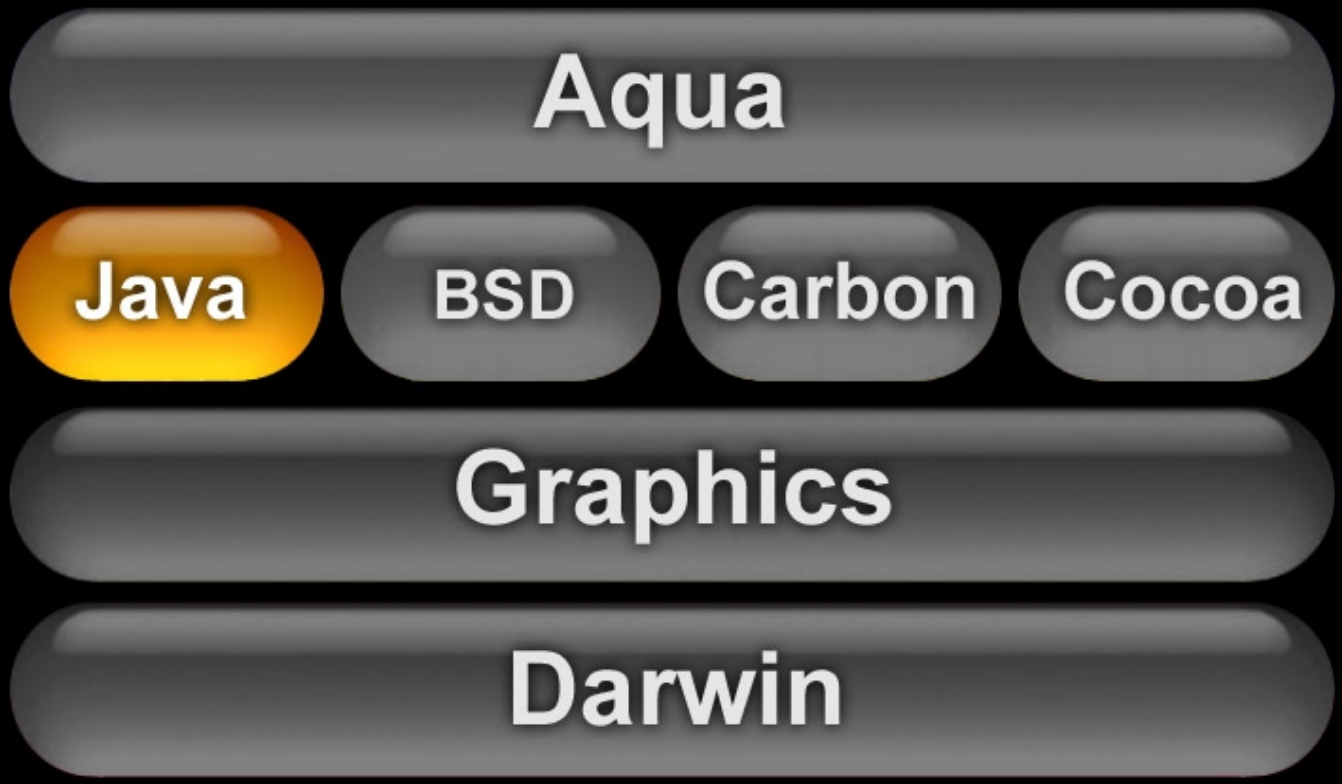
Carbon
Cocoa
Graphics
Darwin

Aqua

Java | BSD | Carbon | Cocoa

Graphics

Darwin


Aqua
Java
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Carbon
Cocoa
Graphics
Darwin

Bring Cross-Platform Apps to Mac OS X

Who Are These Java Heads?

- Cross platform for many platforms
  - Mac
  - Windows
  - Solaris
  - Linux
- Enterprise customers
- Intranet solutions

Mac OS X is the platform for you!

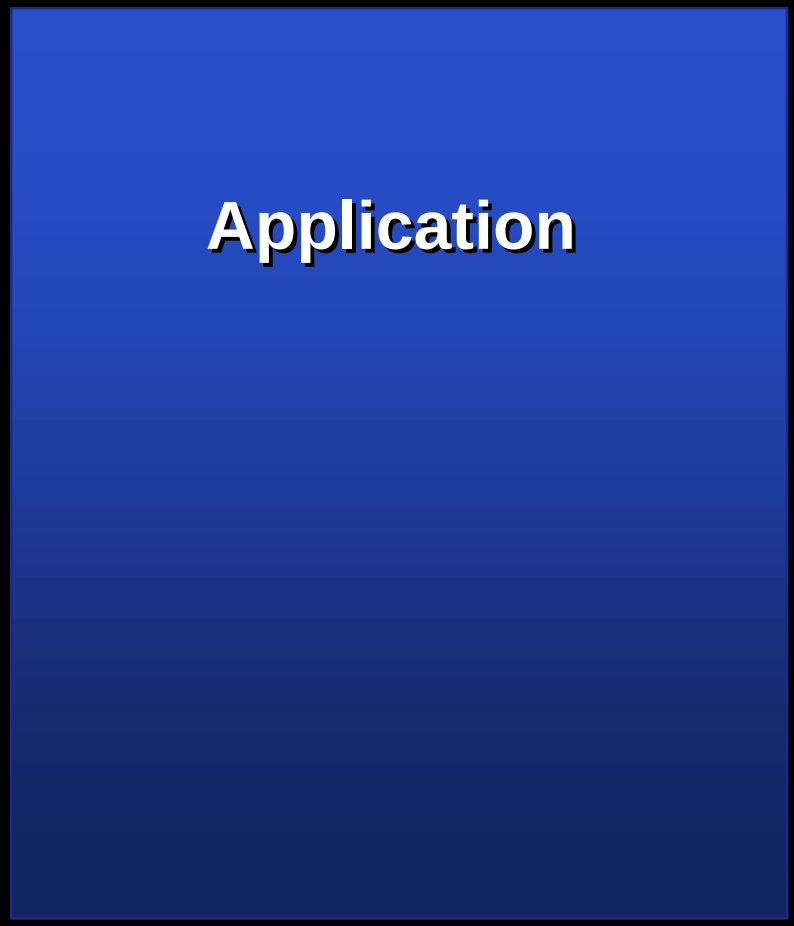
Standard Java

- Java 2 Standard Edition Version 1.3
- Swing UI toolkit
- HotSpot client VM
- Java 2D
- Printing support
- Drag & drop

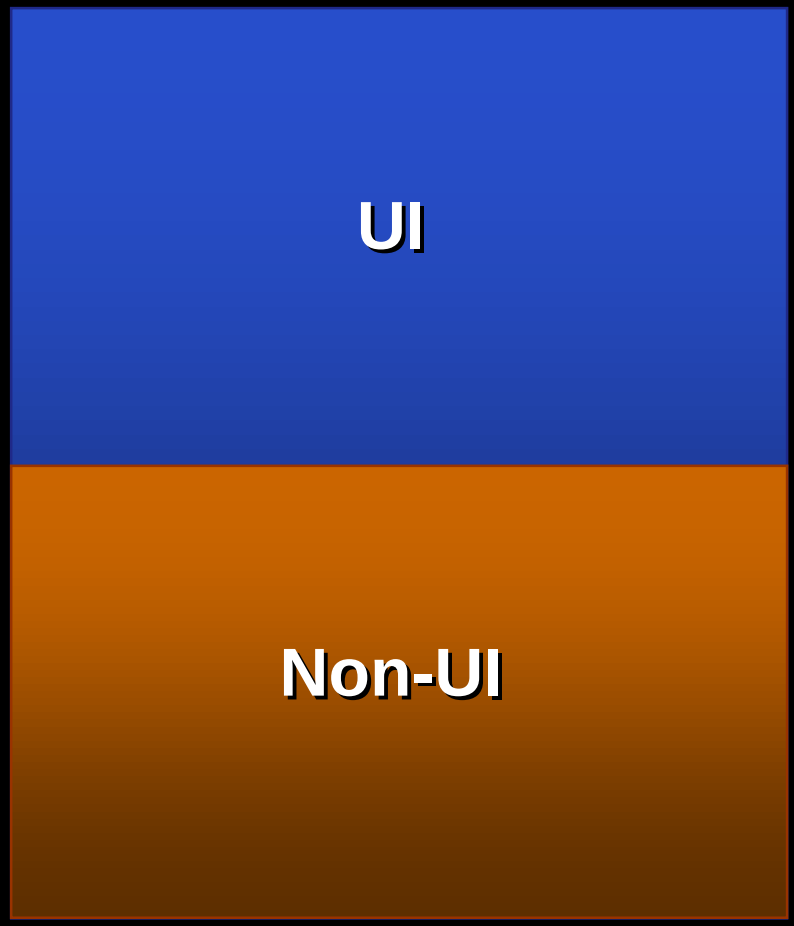
Premium Caffeine

- Aqua look and feel
- Performance: shared Swing
- QuickTime for Java
- Double-clickable apps
- Mac OS X additions through JavaBeans
- WebObject 5.0

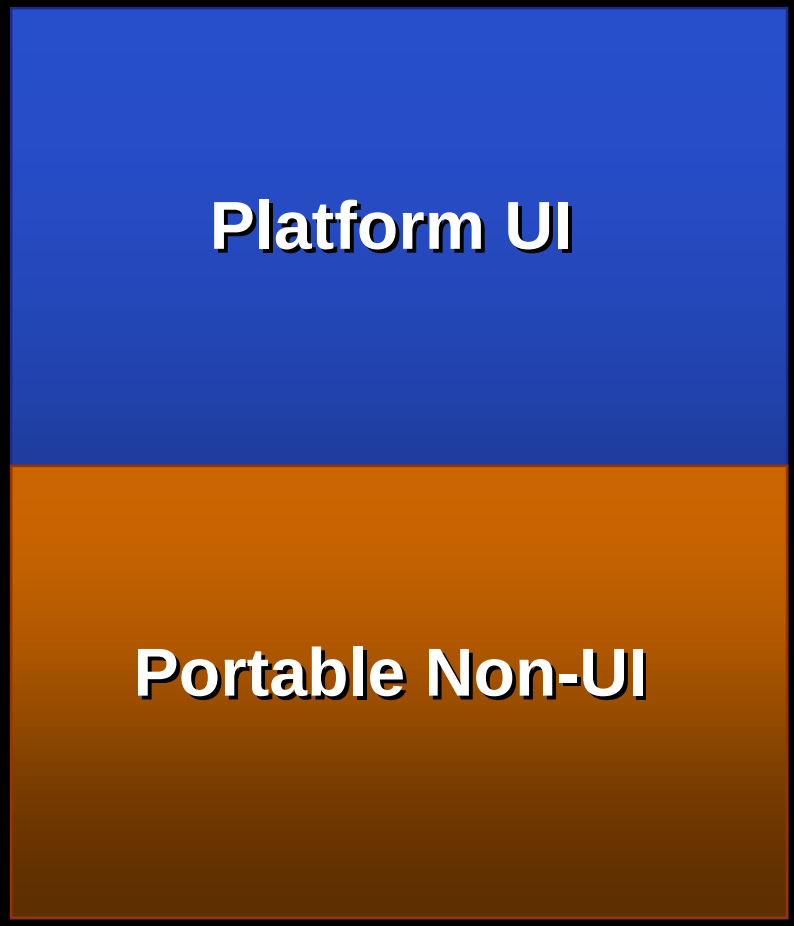
Other Cross-Platform Solutions



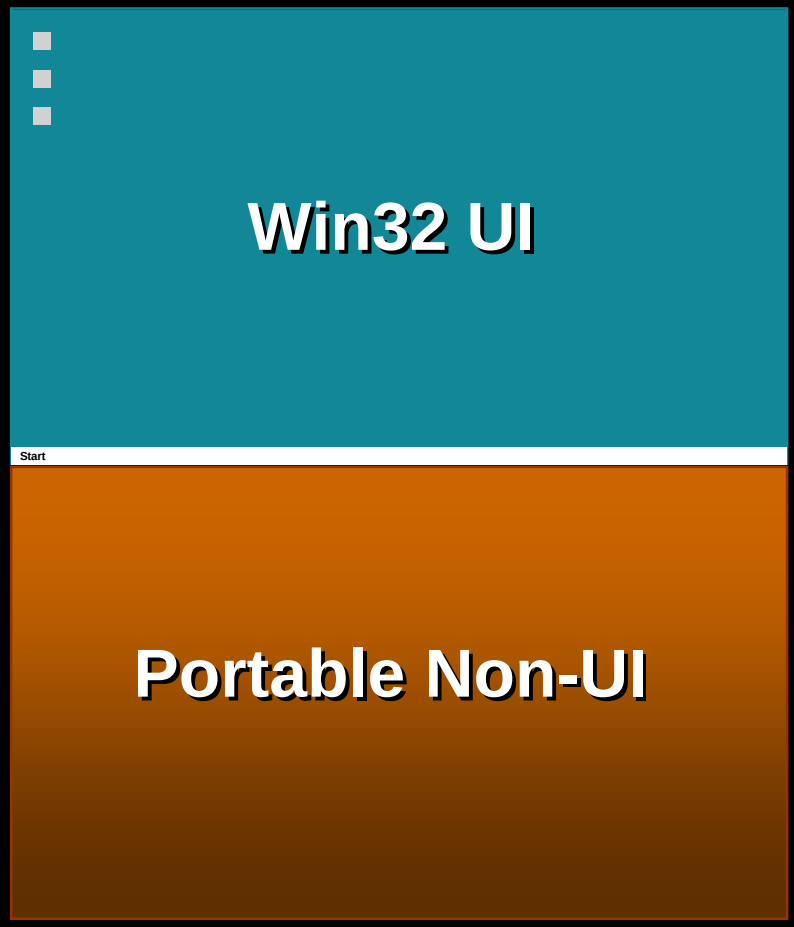
Other Cross-Platform Solutions



Other Cross-Platform Solutions



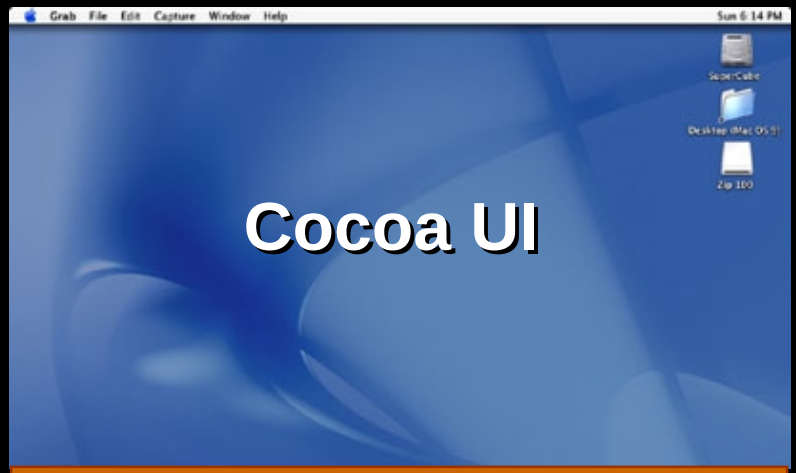
Other Cross-Platform Solutions



Other Cross-Platform Solutions

Portable Non-UI

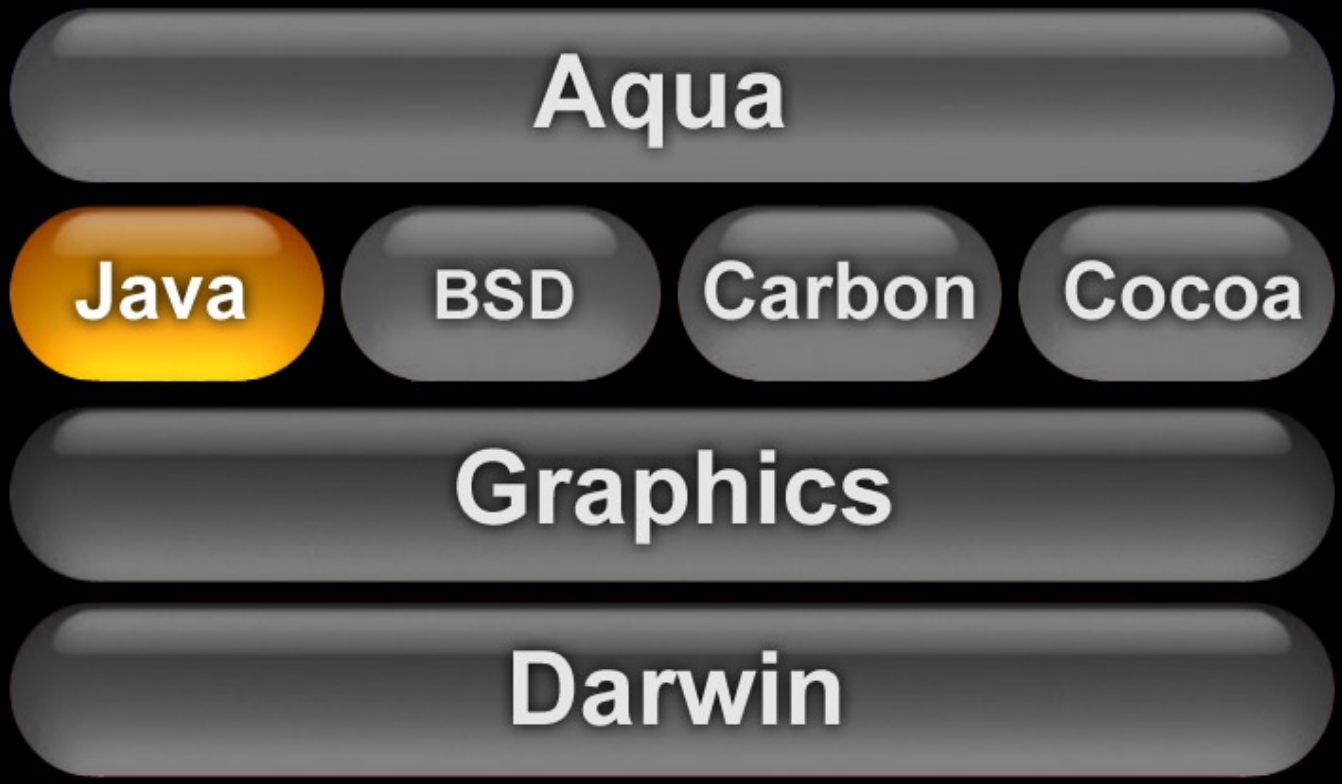
Other Cross-Platform Solutions



Portable Non-UI

Mac OS X:
Single Stop Shopping for Java

- A single runtime
- A great development platform
- A great deployment platform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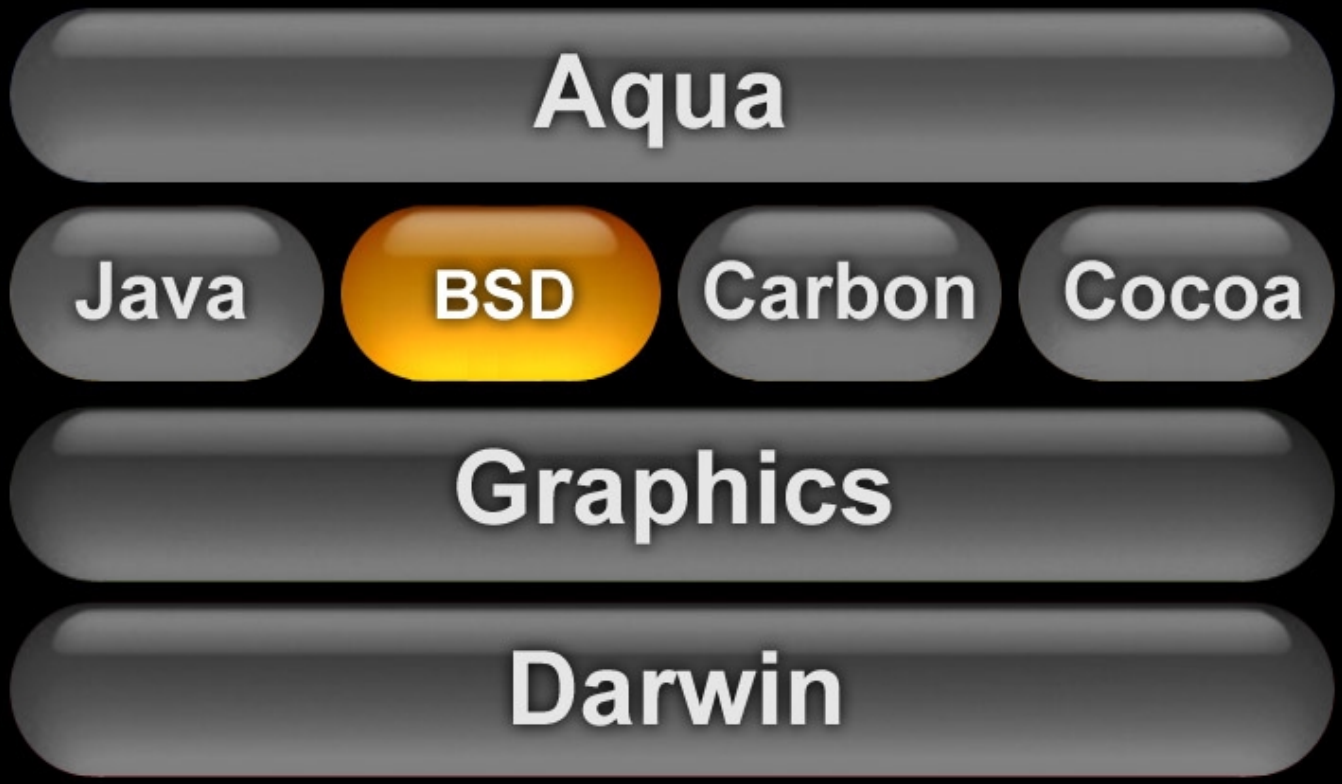
Darwin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Graphics
Darwin

Bring Unix Apps to Mac OS X

Bring It On

- Hundreds of gnu projects
- Thousands of POSIX-based applications
- Millions of lines of code written for Unix-based operating systems
- BSD layer—built into Mac OS X—enables bringing these apps to the Mac

BSD

- Based on BSD 4.4
- Open source

APIs and Tools

- Public “POSIX”/BSD APIs
  - Standard C library, stdio, pthreads, Math library, etc.
- Command line tools and utilities
  - ssh, finger, ftp, cp, ls, mkdir, ps, kill, top, shutdown, grep, NetInfo, DNS/BIND, NTP, syslog, Apache, etc.

Good Isn't Good Enough… Build a Great App

- Porting BSD/POSIX apps to Mac OS X is easy
- Don't forget to build a great UI!

A Great UI?

```
 7.   0.86      7     30915      Nf3 Nf6 Nc3 Nc6 e4 e5 Bc4
 8&   1.39     -5     61250      Nf3 Nf6 Nc3 e6 e4 Bb4 Bd3 Nc6
 8&   1.94     -1     93796      Nc3 Nf6 e4 e5 Nf3 Bb4 Bb5 Bxc3 dxc3
 8.   2.24     -1    114045      Nc3 Nf6 e4 e5 Nf3 Bb4 Bb5 Bxc3 dxc3

Time = 2.2 Rate=50818 Nodes=[103574/10471/114045] GenCnt=116212
Eval=[27807/52483] RptCnt=3 NullCut=6341 FutlCut=7085
Ext: Chk=1345 Recap=386 Pawn=162 OneRep=111 Horz=8 Mate=0 KThrt=136
Material=[3600/3600 : 4400/4400] Lazy=[100/100] MaxPosnScore=[159/188]
Hash: Success=26% Collision=10% Pawn=85%

black  KQkq
r n b q k b n r
p p p p p p p p
. . . . . . . .
. . . . . . . .
. . . . . . . .
. . N . . . . .
P P P P P P P P
R . B Q K B N R


My move is : Nc3
Black (1) :
```

A Great UI?

```
 7.   0.86      7     30915      Nf3 Nf[illegible]3 Nc6 e4 e5 Bc4
 8&   1.39     -5     61250      Nf3 Nf[illegible]c3 e6 e4 Bb4 Bd3 Nc6
 8&   1.94     -1     93796      Nc3 N[illegible]4 e5 Nf3 Bb4 Bb5 Bxc3 dxc3
 8.   2.24     -1     11[illegible]5      Nc3 N[illegible]4 e5 Nf3 Bb4 Bb5 Bxc3 dxc3

Time = 2.2 Rate=[illegible]des=[103574/10[illegible]14045] GenCnt=116212
Eval=[27807/52463] Rp[illegible]=3 NullCut=63[illegible]lCut=7085
Ext: Chk=1345 Recap=386 [illegible]wn=162 OneRep[illegible]rz=8 Mate=0 KThrt=136
Material=[3600/3600 : 440[illegible]400] Lazy=[1[illegible] MaxPosnScore=[159/188]
Hash: Success=26% Collision[illegible]% Pawn=85%

[illegible]KQkq
[illegible] r
 p p [illegible]
. . . . .
. . . . . .
. . . . . .
. . N . . . .
P P P P [illegible] P P P
R . B Q K [illegible] N R


My move is : [illegible]
Black (1) : [illegible]
```

NO

A Great UI?

```
my move: F3
   A B C D E F G H J K L M N O P Q R S T
19 - - - - - - - - - - - - - - - - - - - -19
18 - - - - - - - - - - - - - - - - - - - -18
17 - - - O - - - - - - - - - - - - - - - -17
16 - - - + - - - - - + - - - - - + - - -16     Your color: Black X
15 - - O - - - - - - - - - - - - - - - - -15     My color:   White O
14 - - - - - - - - - - - - - - - - - - - -14
13 - - - - - - - - - - - - - - - - - - - -13
12 - - - - - - - - - - - - - - - - - - - -12
11 - - - - - - - X - - - - - - - - - - - -11     You have captured 0 pieces
10 - - - + - - - - - + - X - - X + - - -10     I have captured 0 pieces
 9 - - - - - - - - - - - - - - - - - - - 9
 8 - - - - - - - - - - - - - - - - - - - 8
 7 - - - - - - - - - - - - - - - - - - - 7
 6 - - - - - - - - - - - - - - - - - - - 6
 5 - - - - - - - - - - - - X - - - - - - 5
 4 - - - O - - - - - + - - - - - + - - - 4
 3 - - - - - O - - - - - - - - - - - - - 3
 2 - - - - - - - - - - - - - - - - - - - 2
 1 - - - - - - - - - - - - - - - - - - - 1
   A B C D E F G H J K L M N O P Q R S T

your move? 
```

A Great UI?

```
my move: F3
   A B C D E F G H J K L M N O P Q R S
19 - - - - - - - - - - - - - - - - - - -
18 - - - - - - - - - -   - - - - - - -
17 - - - O - - - -   - - - - - - - - -
16 - - - + - -   - - - - - + - -
15 - - O - - - - - -   - - - - - - -
14 - - - - - - - - -   - - - - - - -
13 - - - - - - - - - -   - - - - - - -
12 - - - - - - - - - - -   - - - - - -1
 1 - - - - - - - X - - - -   - - - - -11
   - - + - - - - - + - X - -   + - - -10
   - - - - - - - - - - - - - - - - - - 9
 8 - -   - - - - - - - - - - - - - - - 8
   - - - -   - - - - - - - - - - - - 7
 6 - - - - - -   - - - - - - - - - - 6
 5 - - - - - - -   - - - - - - - - - 5
 4 - -   O - - - - - + - -   - - - -
 3 - -   - - O - - - - - - - -
 2 - - -   - - - - - - - - - - - -
 1 - - - -   - - - - - - - - - - - -
   A B C D E   G H J K L M N O P Q R S T

your move? [
```

```
Your color: Black X
My color:   White O
```

```
have captured 0 pieces
e captured 0 pieces
```

NO

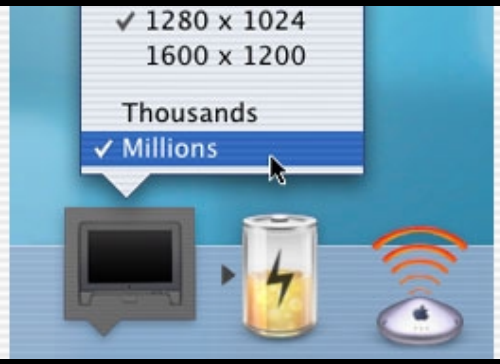
BSD

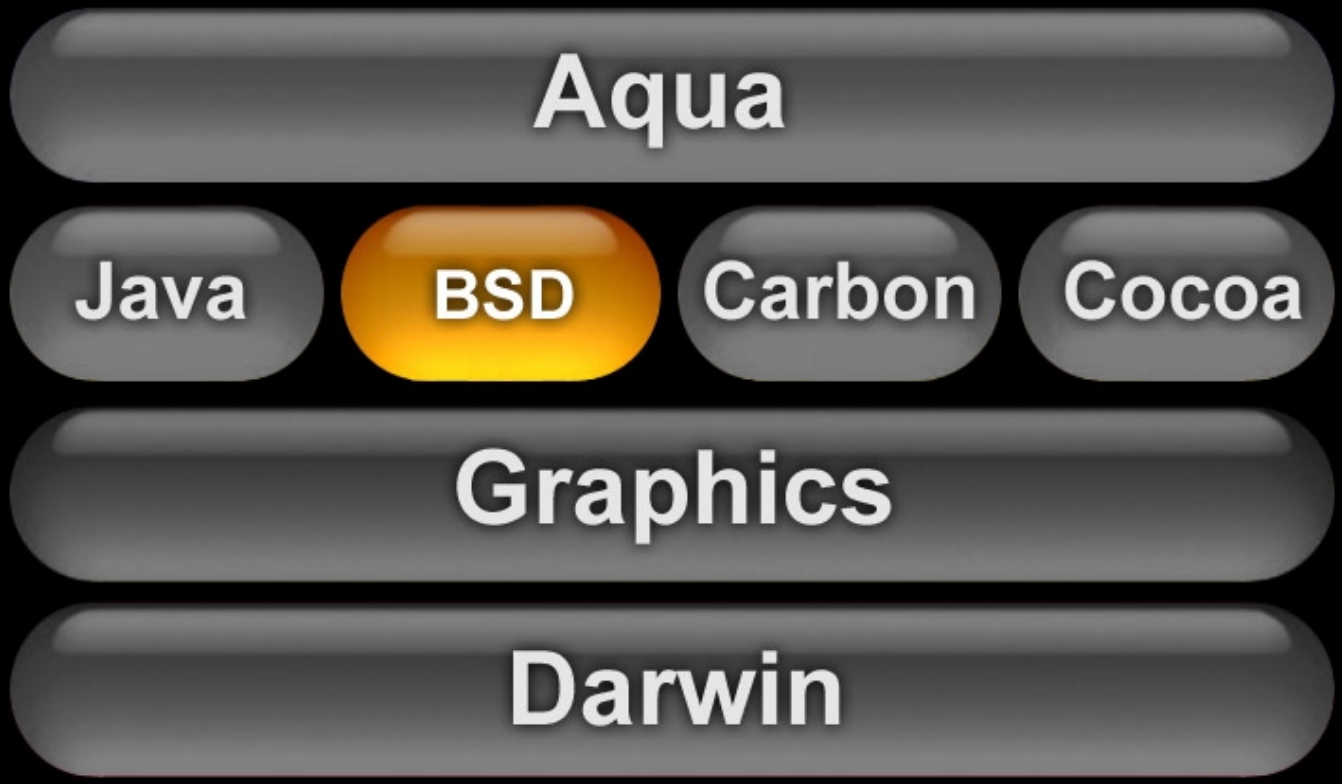
Carbon

BSD

Carbon
Cocoa
BSD

Demo




Aqua
Java
BSD
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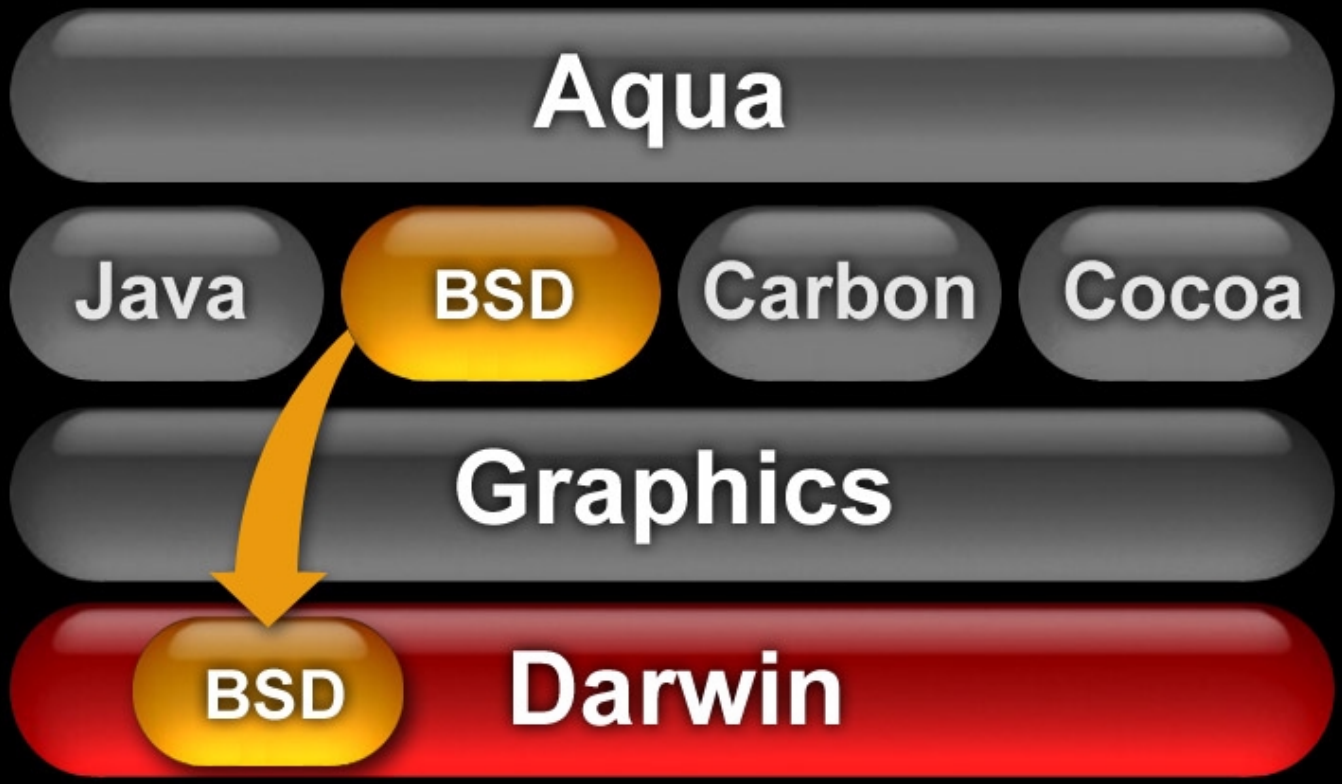
Aqua
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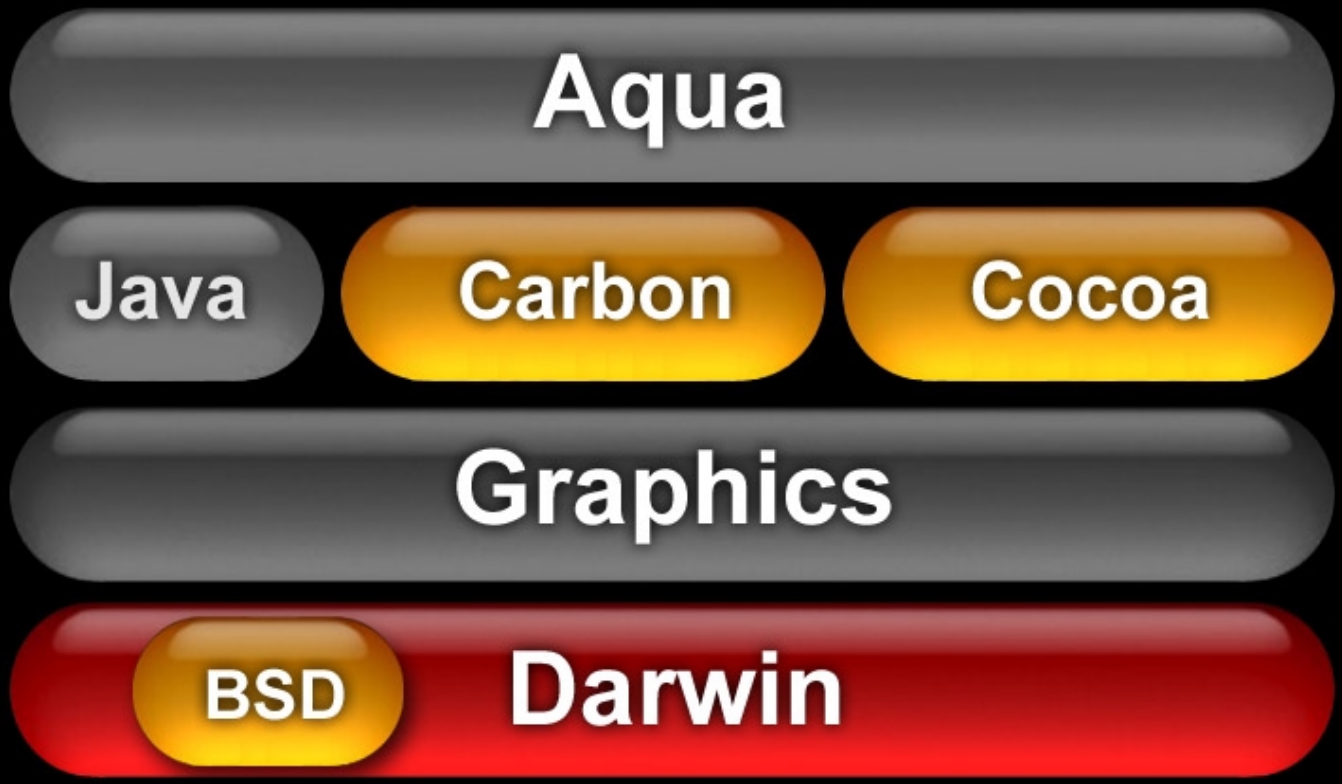
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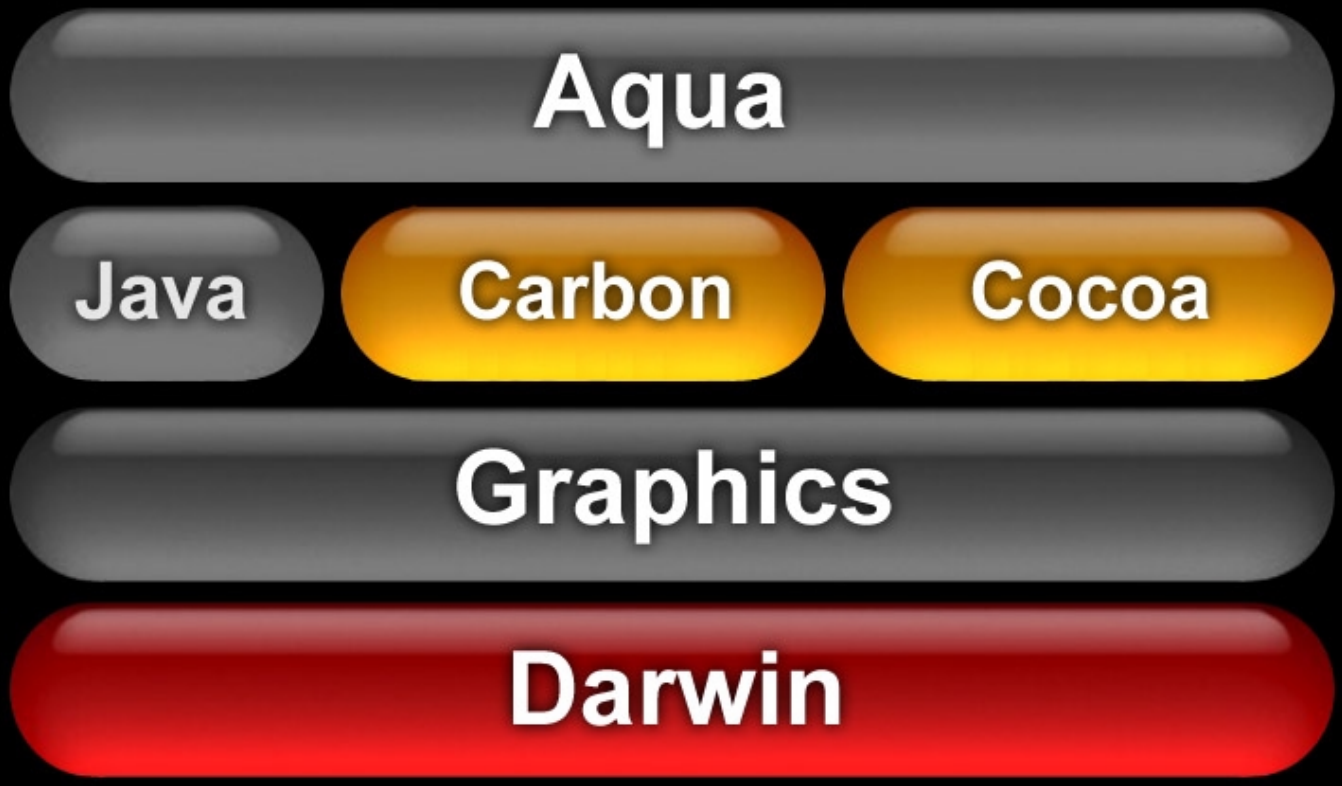
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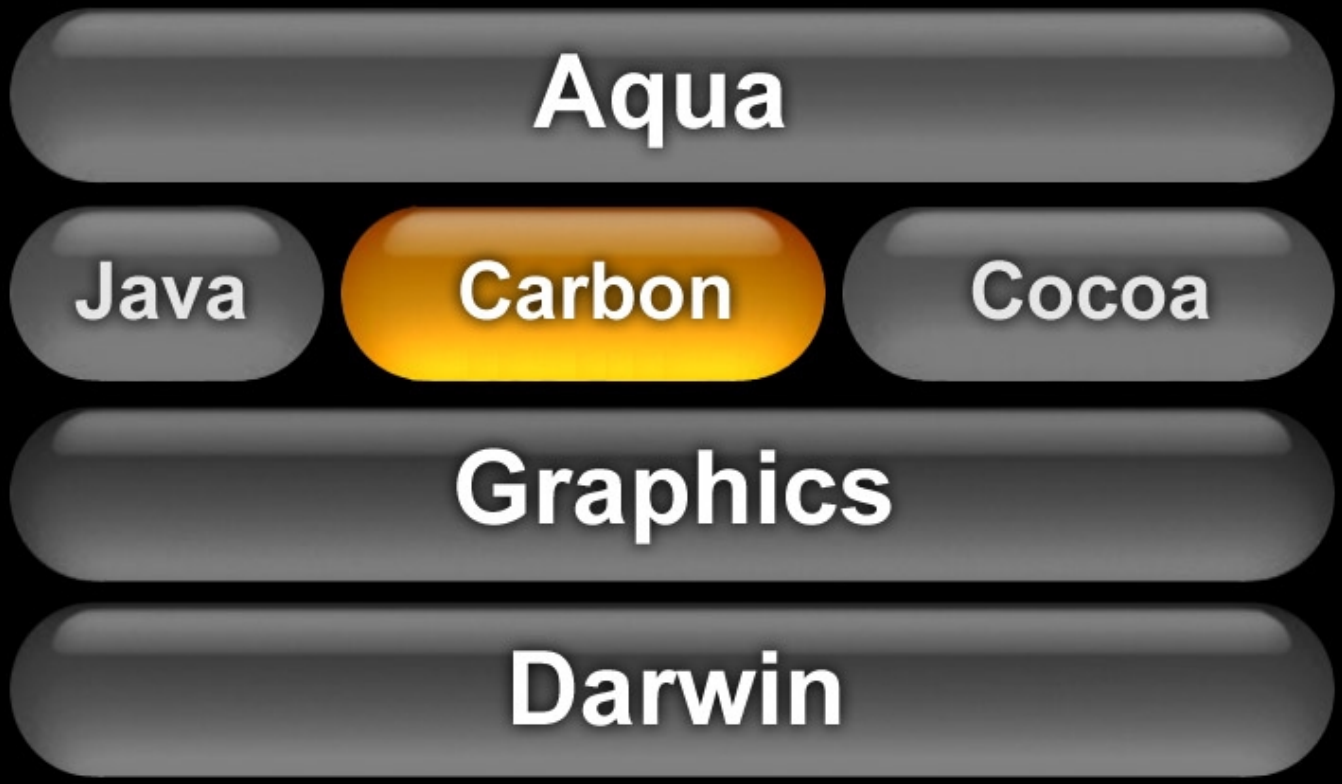

Aqua
Java
Carbon
Cocoa
Graphics
Darwin

Bring Mac OS 9 Apps to Mac OS X

Only Applications?

- Carbonize
  - Applications
    - Foreground and background
  - Plug-ins
    - CFBundle and CFPlugIn can help
- Do NOT Carbonize
  - Device drivers
    - Use Device Manager on Mac OS 9
    - Write I/O Kit driver on Mac OS X
  - System extensions (INITs)

Don’t Pollute Mac OS X With INITs

What Is Carbon?

Mac OS APIs

What Is Carbon?

Mac OS APIs

Tune-up

Carbon

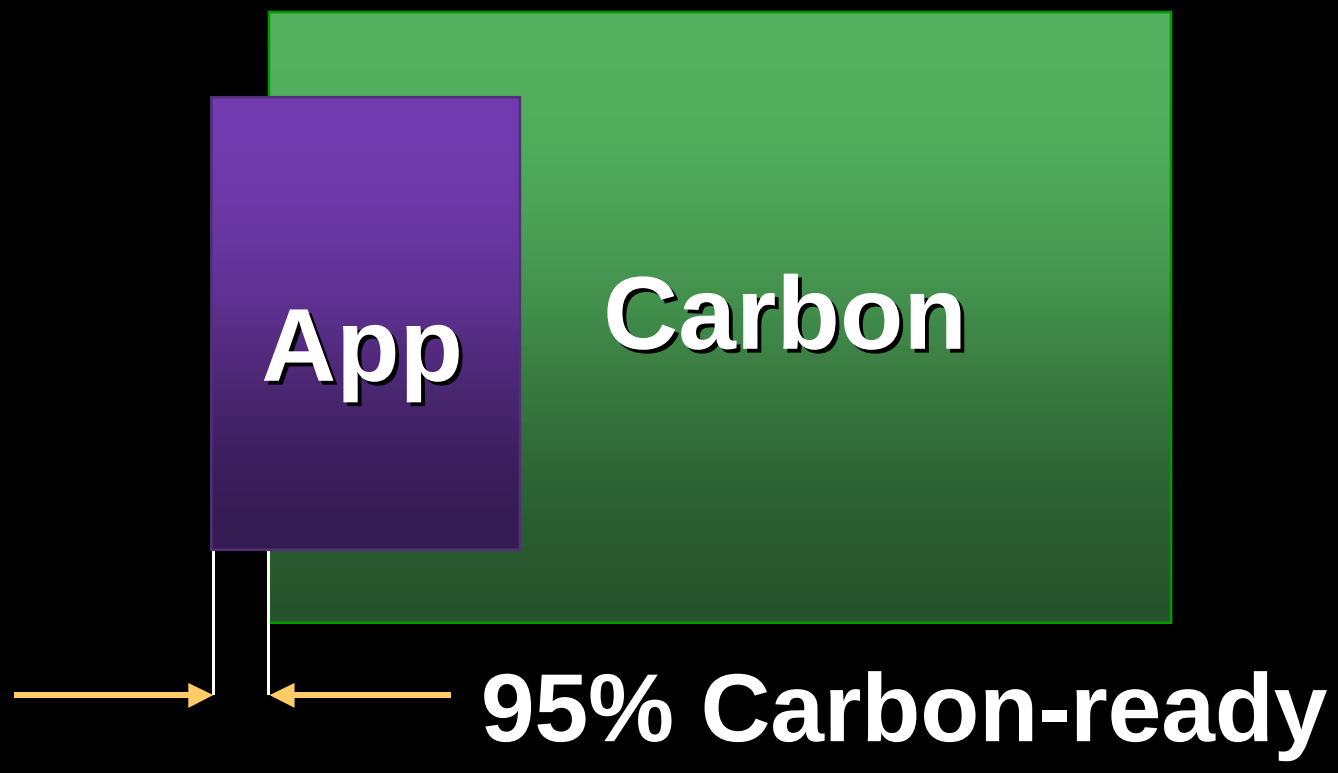
Tune-up

Carbon

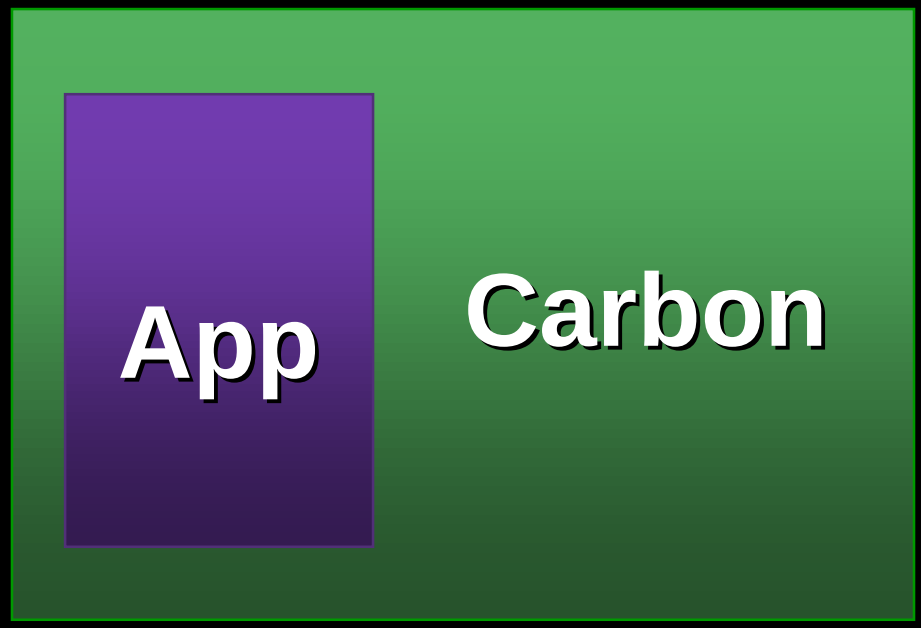
Tune-up

Carbon

Tune-up



Tune-up



Custom Report Just for You

Carbon Dating

Think different.

Home Page | Carbon Specification

Carbon Compatibility Report

Report for: Setup Assistant.ad

File Creator: mbda

File Type: APPL

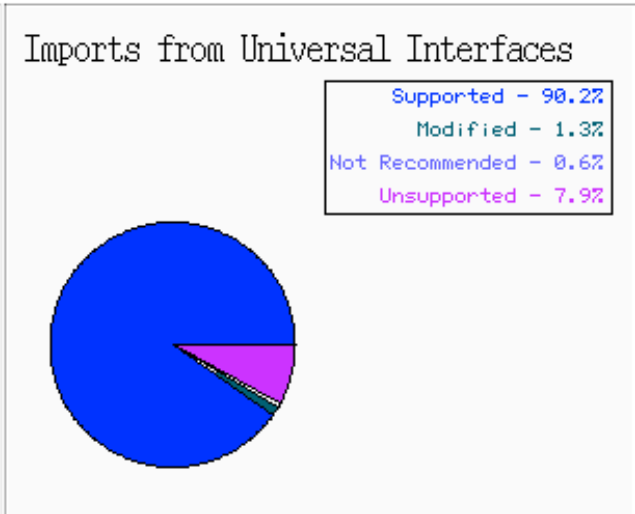
Report date: 8/6/99

Data gathered by analyzer version: 1.2

Data gathered on: 8/5/99

Summary

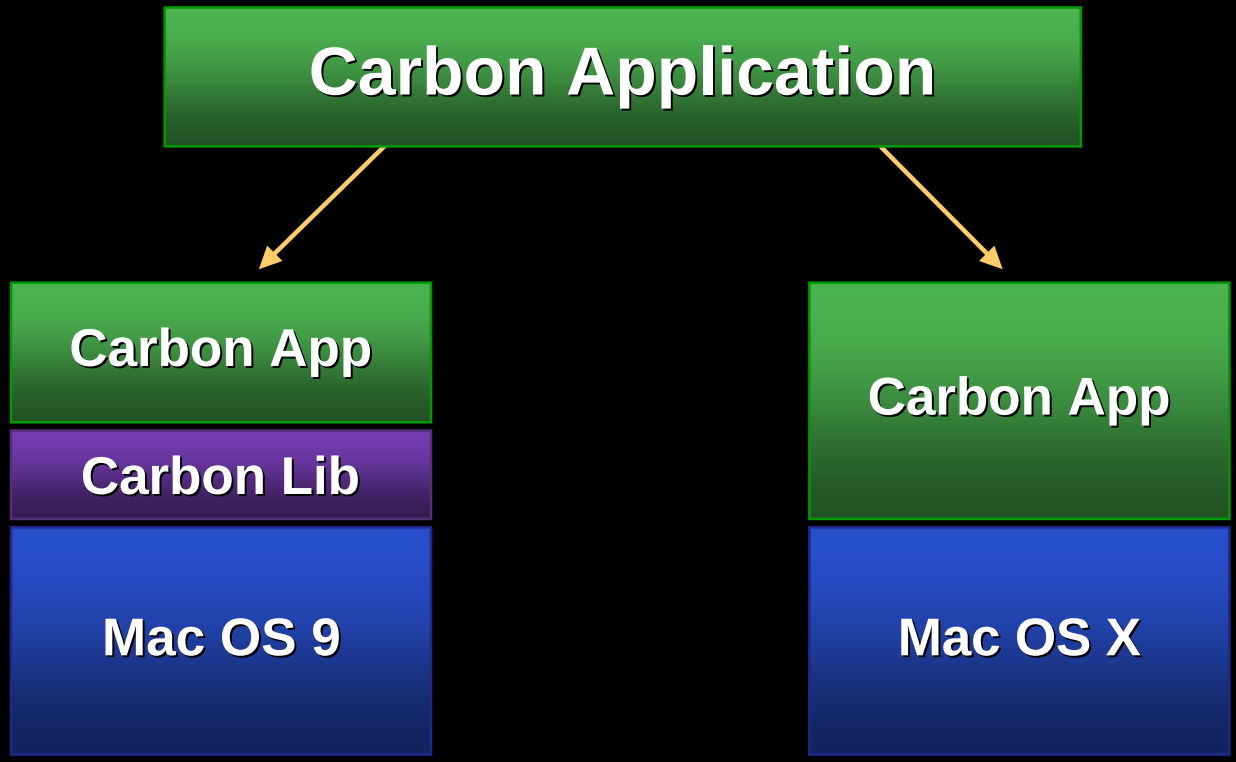
Test	Number
Analysis of Imports	
Supported API	469
Supported with Modifications	7
Supported But Not Recommended	3
Unsupported API	41
Analysis of Access to Low Memory Addresses	
Analysis of Resources Loaded into System Heap	



Carbonization Basics

- Adopt accessors
- Use new toolbox UPPs
- Navigation Services
- Apple Help

Write Once, Run MacEverywhere

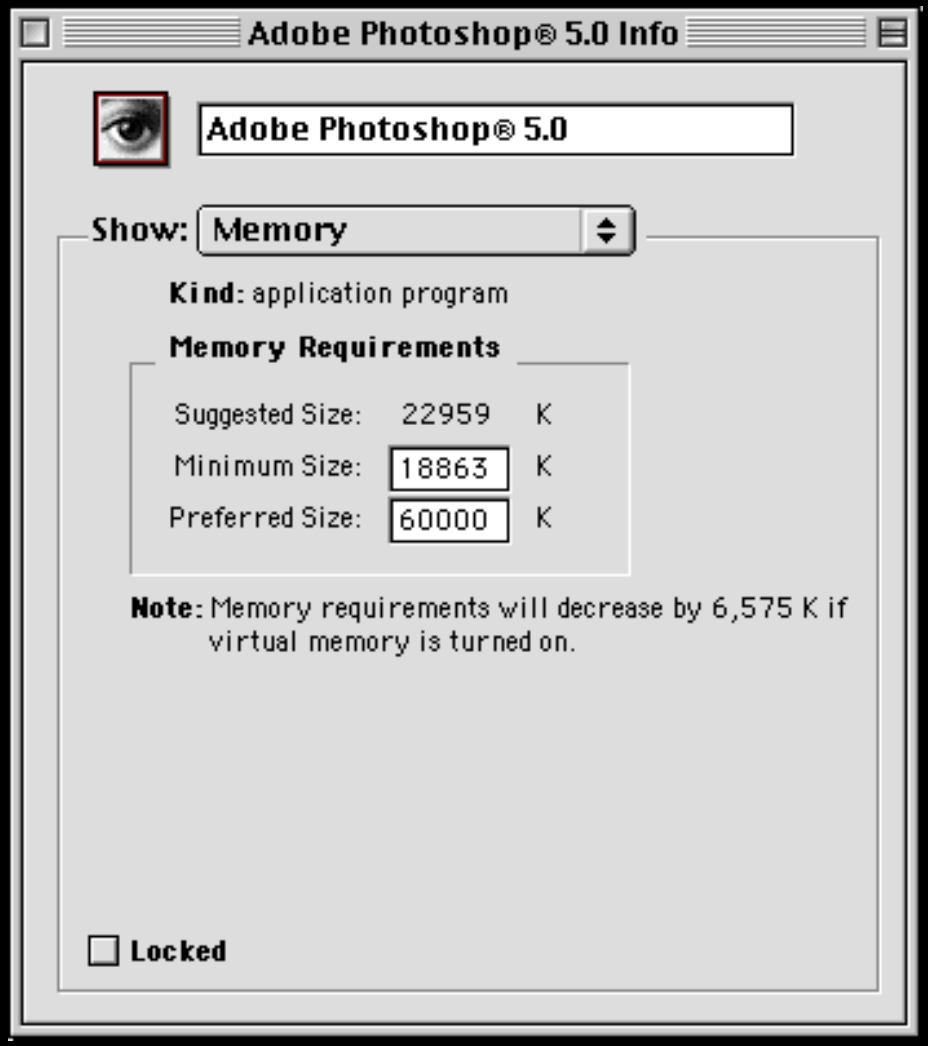


Killer Benefits

- Stability
  - Protected memory
  - Preemptive scheduling
- Responsiveness
  - Preemptive scheduling
  - Threading

Killer Benefits

- FileManager automatically supports multiple filesystems
  - Mac OS Standard (HFS)
  - Mac OS Extended (HFS+)
  - UFS
  - NFS
  - WebDAV
- Automatic memory management


Adobe Photoshop® 5.0 Info
Adobe Photoshop® 5.0
Show: Memory
Kind: application program
Memory Requirements
Suggested Size: 22959 K
Minimum Size: 18863 K
Preferred Size: 60000 K
Note: Memory requirements will decrease by 6,575 K if virtual memory is turned on.
Locked

cation program
irements
959 K
K
Preferred
Note: Memory requir
virtual memory is
se by 6,575 K if

ert Format Tools Slide Show Window Help 4:56 AM

100%

No Effect

1

Memory is too full to perform the operation. Try again after closing a window, or try increasing PowerPoint's preferred memory size with Get Info.

OK

There W

- What are t
- What exac
- What are the developer benefits of Carbon?
- How do I build a great Carbon application?
- When should I Carbonize?

on?
n?
Carbon?
ication?

Benefits
ity
rmance and responsiveness
experience

Format
Tools
Help
4:56 AM
100%
No Effect
full to perform the operati
a window, or try increa
rred memory size with
Info.
Benefits
rmance and responsiveness
experience
Carbon application?

AQUA

Finder
File
Edit
View
Go
Window
Help
11:23 AM
as Columns
as Icons
as List
Clean Up
Arrange by Name
Hide Toolbar ⌘B
Customize Toolbar...
Show Status Bar
Show View Options ⌘J
Documents
Back
View
Computer
Home
Favorites
Applications
My Project
Homework
Ladybug
Star Fish
MP3
Jazz
Read me
QuickTime Player
00:12:23
untitled document
Save as: Flowers
Where: Documents
Save Image Preview
Cancel
Save
TextEdit
pdf

Finder File Edit View Go Window Help 11:23 AM

as Columns
✓ as Icons
as List

Clean Up
Arrange by Name

Hide Toolbar ⌘B
Customize Toolbar...
Show Status Bar

Show View Options ⌘J

Back View

Homework

Untitled-1

Read me

QuickTime Player

00:12:23

Document Setup

Page size: Letter

Dimensions: 8.5 by 11 inches

Orientation: Tall Wide

Options: Double-sided Adjust layout
Facing pages Restart page numbering

Number of pages: 1 Start page #: 1

Margins

Inside 1 inches Outside 0.75 inches
Top 0.75 inches Bottom 0.75 inches

Target output resolution: 300 dpi

OK
Cancel
Numbers...

TextEdit

Aqua

- Retain Platinum metrics
- Some new behaviors require adoption
- Take opportunity to polish application
  - Aqua sets the stage for greater attention to UI

I Feel the Need for Speed

- Different performance characteristics for some APIs on Mac OS X
- Kernel calls more expensive than just checking a variable in Mac OS 9
- Laziness is a virtue

I Feel the Need for Speed

- If you don't have anything good to process, don't process anything at all
- Don't bogart the memory

I Feel the Need for Speed

- Measure
- Measure
- Measure
- (and fix!)

Carbon Events

- Simplify and reduce code
  - Events dispatched directly to handlers
  - Default functionality handled automatically
- Customize toolbox behaviors
  - Generic patching removed
- Help with performance
  - Sending events when needed removes unnecessary polling

Threading

- Thread Manager
  - Cooperative scheduling only
- Multiprocessing API
- All threading layered on pthreads

Carbon & Cocoa Shared Goals

- XML
- Unicode
- Event management
- Preference maintenance
- Multilingual
- Simple application packaging

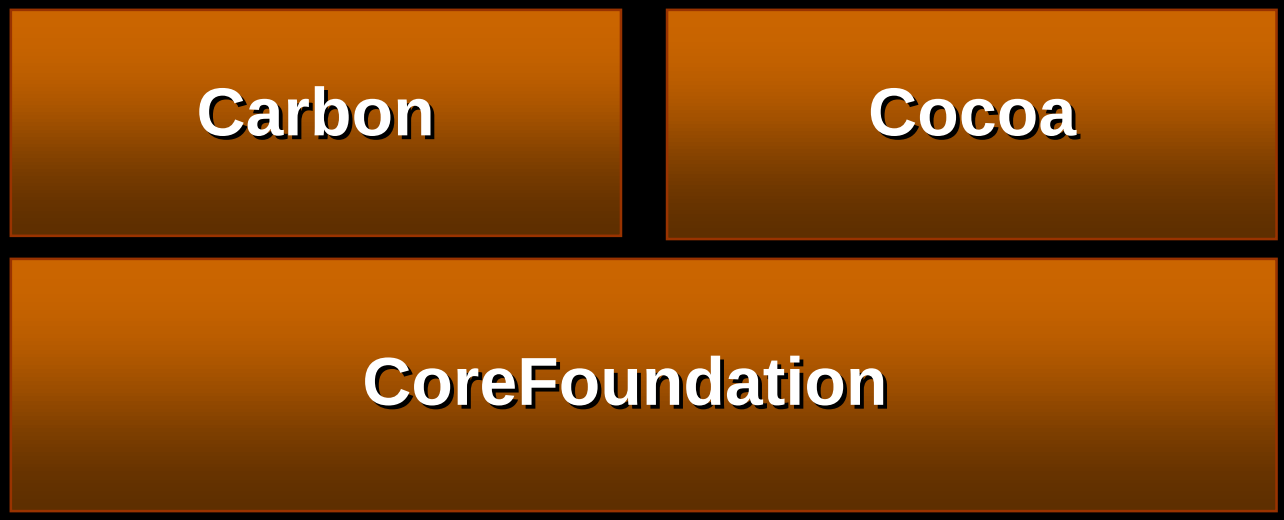
Carbon & Cocoa Shared Goals

Carbon	Cocoa
XML	XML
Unicode	Unicode
Event management	Event management
Preference maintenance	Preference maintenance
Multilingual	Multilingual
Simple application packaging	Simple application packaging

Carbon & Cocoa Shared Goals

Carbon	Cocoa
XML	Preference maintenance
Unicode	Multilingual
Event management	Simple application packaging

CoreFoundation



CoreFoundation: XML

- Optimized general purpose XML parser
- Open source
- Used throughout system—from driver configurations to UI

CoreFoundation

- Unicode through CFString
- Event management
  - Common event queue
  - Allows mixing of Carbon and Cocoa UI
- Preference maintenance
  - CFPreferences
  - Based on XML

Application Packages

Applications packaged as folder hierarchies

- Multilingual
  - Localized resources stored in subfolders
  - Single Binary Multiple Languages (SBML)
- Mac OS 9 and Mac OS X
  - Package can contain platform-specific binaries
- Simple
  - Application represented by single Finder item
  - Supporting resources and libraries hidden

Additive APIs

- Once an API is in Carbon, it stays in for future versions

API Support—CarbonLib 1.0.4

Mac OS 8.1–Mac OS X

- All Carbon APIs that were part of Mac OS 8.1
- Toolbox accessor functions
- Control, window, and menu properties
- Navigation Services
- Core Foundation
- Carbon printing

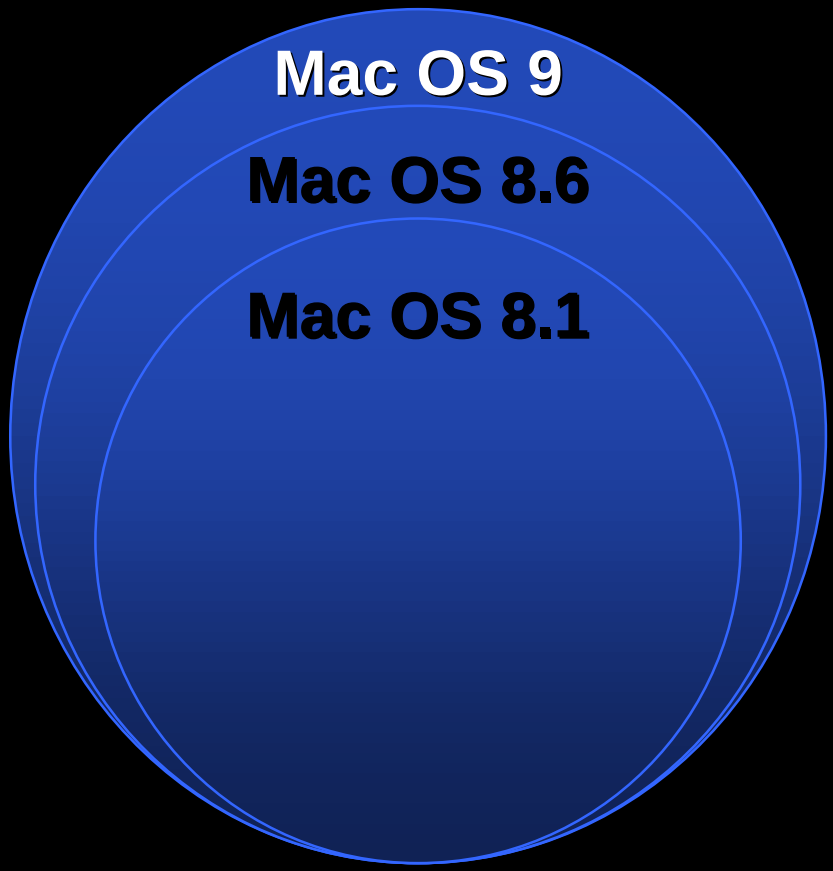
API Support—CarbonLib 1.3.1

Mac OS 8.6–Mac OS X

+ Carbon Event Manager
+ Appearance Manager 1.1
+ IB Carbon Runtime
+ MLTE
+ ATSUI
+ FontSync
+ URL Access
+ XML
+ Keychain Manager
+ Apple Help Viewer

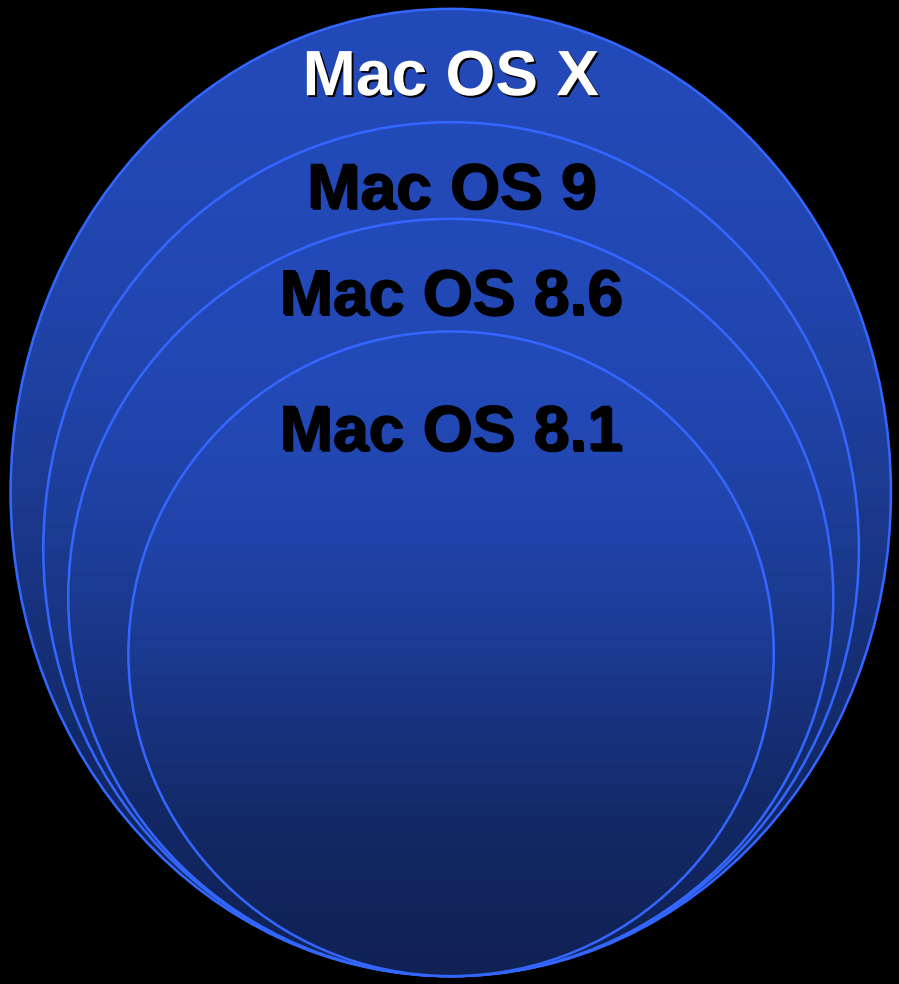
API Support—CarbonLib 1.3.1

Mac OS 9–Mac OS X



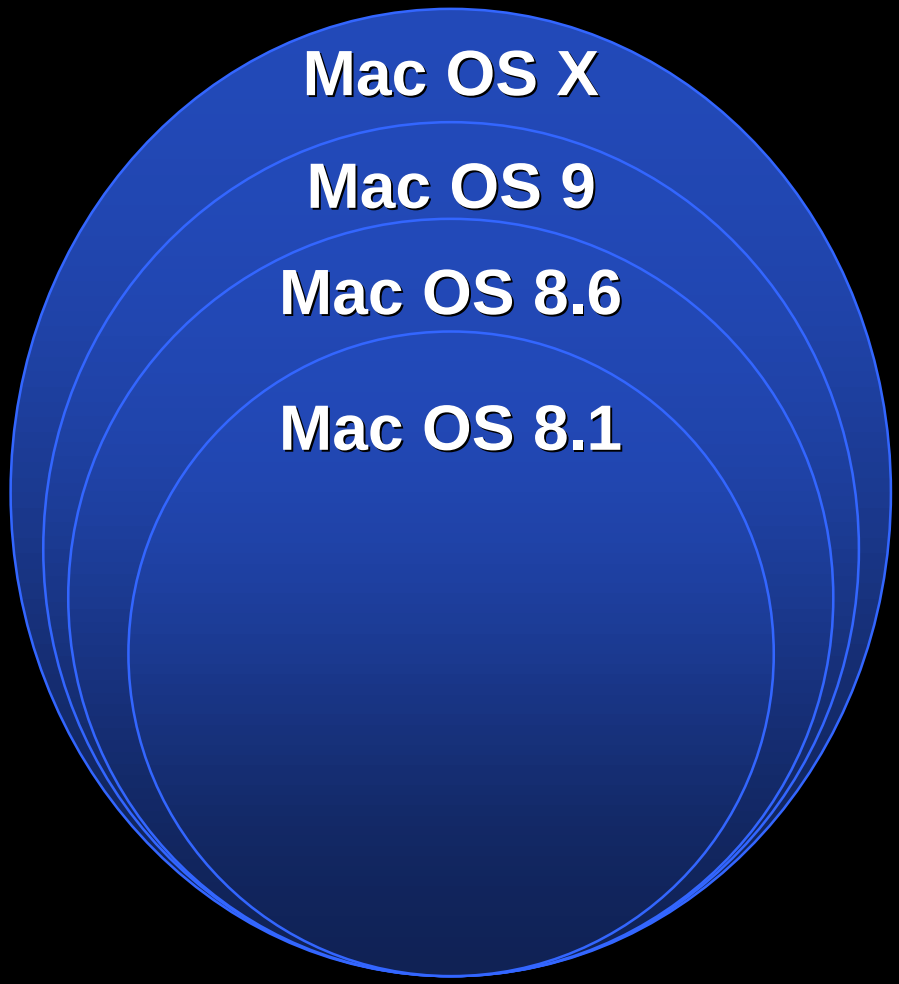
+ HFS Plus APIs
+ Performance and stability enhancements

Carbon on Mac OS X



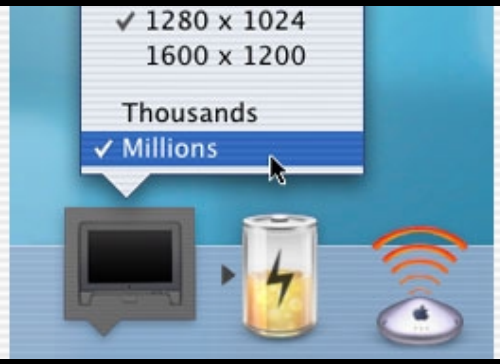
+ Aqua
+ New Carbon APIs
+ Access to other Mac OS X APIs

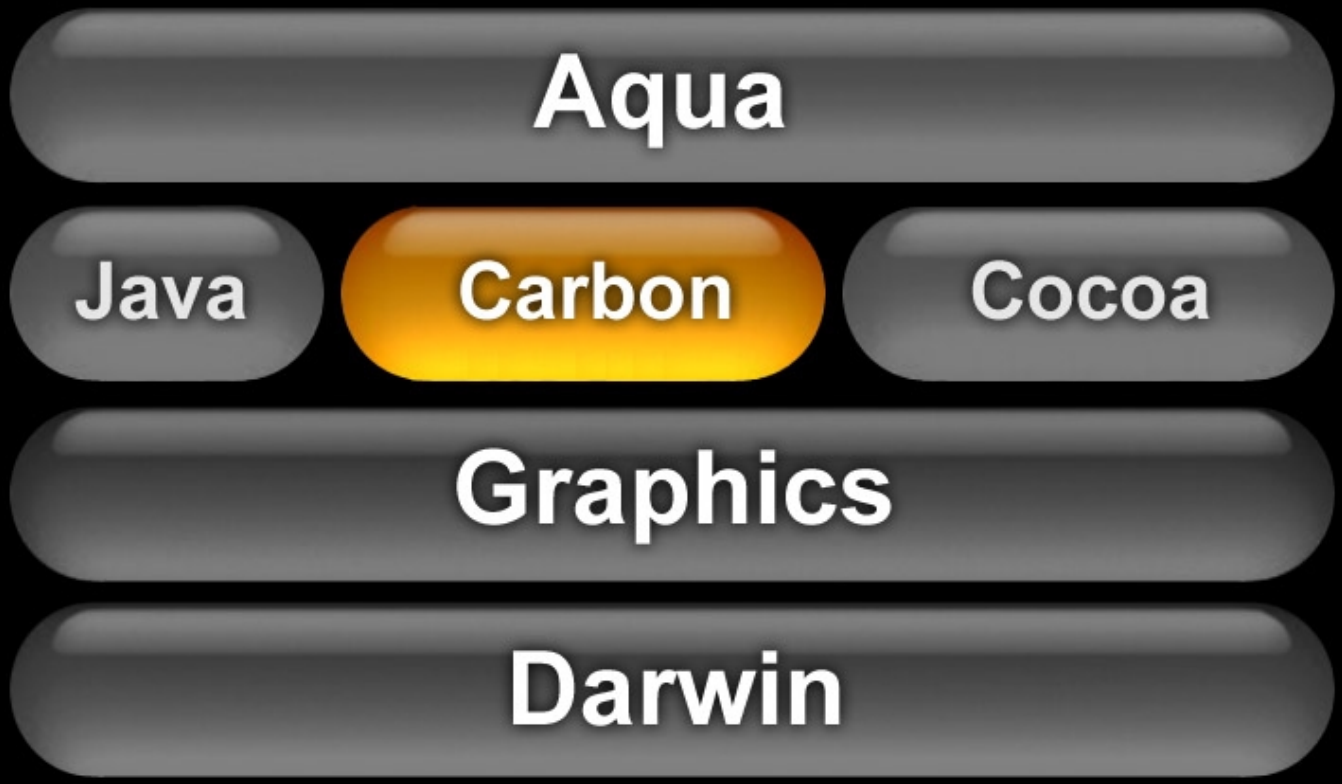
Going Forward

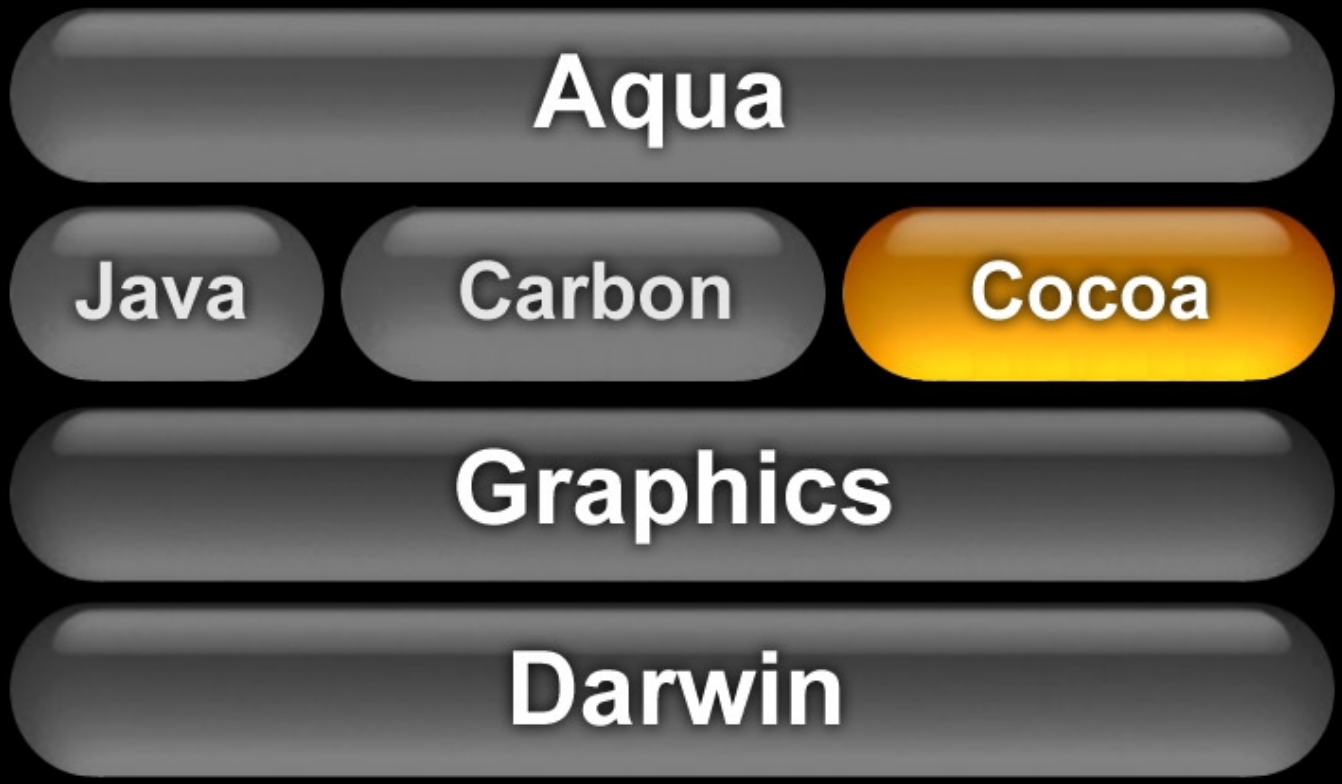


- Carbon is a living, growing API
- Each new release brings along all previous Carbon APIs
- Some new APIs are brought back to previous versions of OS

Demo




Aqua
Java
Carbon
Cocoa
Graphics
Darwin


Aqua
Java
Carbon
Cocoa
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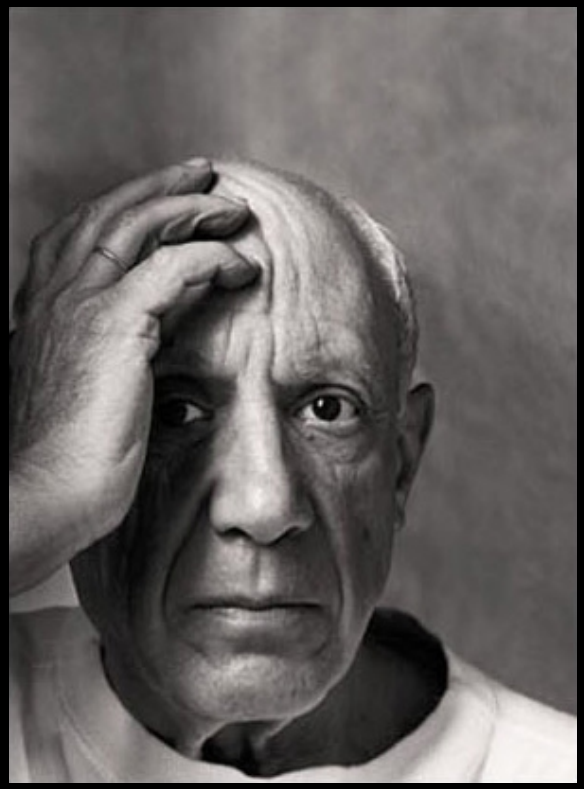
Create the Next Killer App



Unlock the Creative Genius of Developers

Provides All Benefits of Mac OS X and Carbon

- Protected memory
- Preemptive scheduling and threading
- Automatic memory management
- Aqua
- CoreFoundation
- Integration with other system components

Accelerates Development

- Object-oriented
- Designed for extensibility
- Dynamic runtime
  - Supports introspection
  - Runtime determination of action handlers
  - Enables more powerful RAD tools
- Compact code

Easy to Use

- Consistent APIs
- APIs in Objective-C and Java
- Available from C, C++, Objective-C, and Java applications

You Want It, We've Got It

- Widgets galore!
- Document architecture
  - Support multiple documents
  - Run Open and Save panels
- Undo
  - Built into document architecture and text system

You Want It, We've Got It

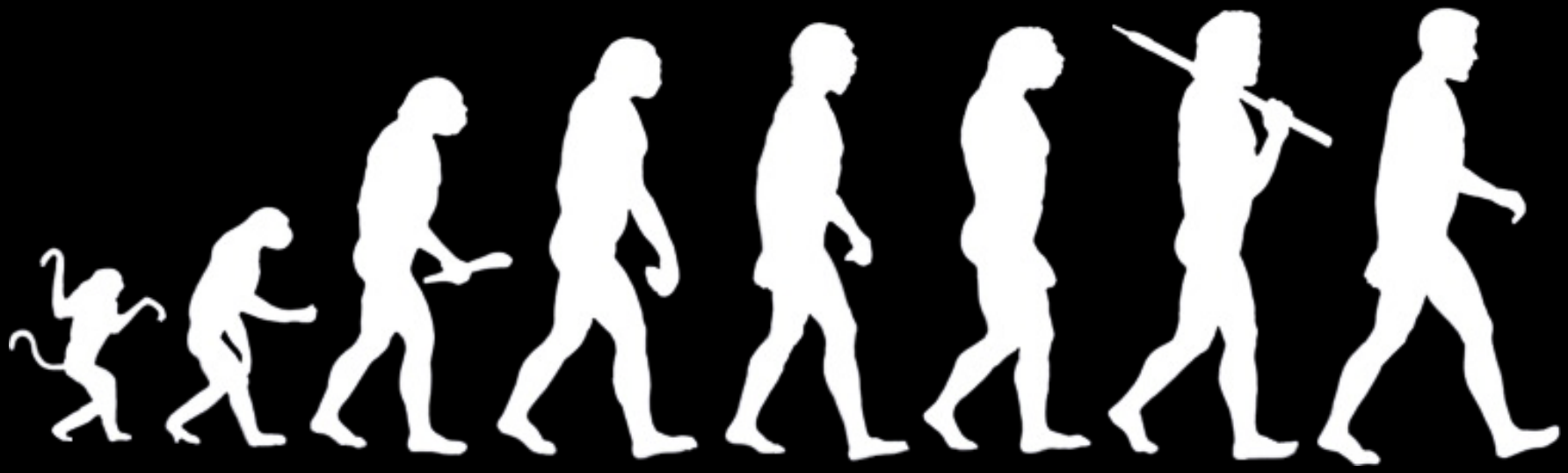
- Scripting architecture
- Text system
  - Unicode
  - Anti-aliased Quartz text
  - Inline spell checking
  - Used everywhere text appears in a Cocoa app

RAD: Frameworks + Tools

Interface Builder accelerates development

- Visually build and edit UI
- Helps create Aqua-compliant interfaces
- Wire objects together
- Run your interface without compiling
- Supports both Cocoa and Carbon

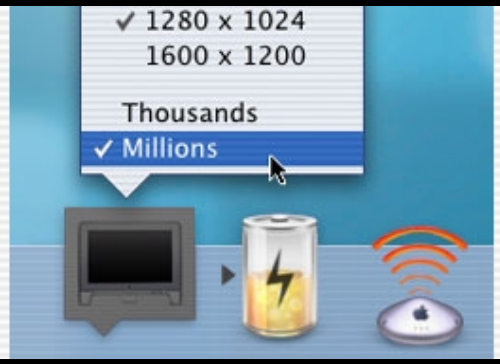
Mature

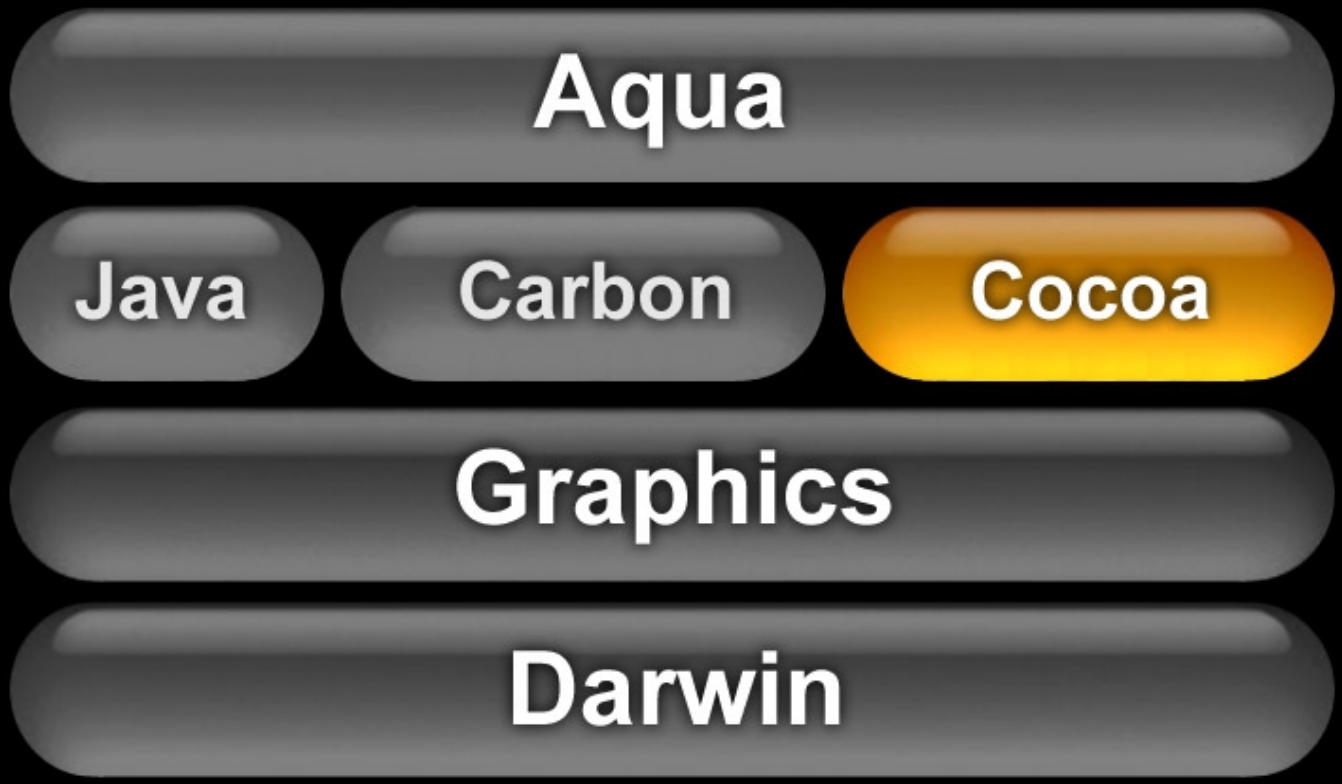


Apple Is Customer #1

- Apple benefits from productivity gains of Cocoa
- Many system apps are Cocoa-based

Demo




Aqua
Java
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Cocoa
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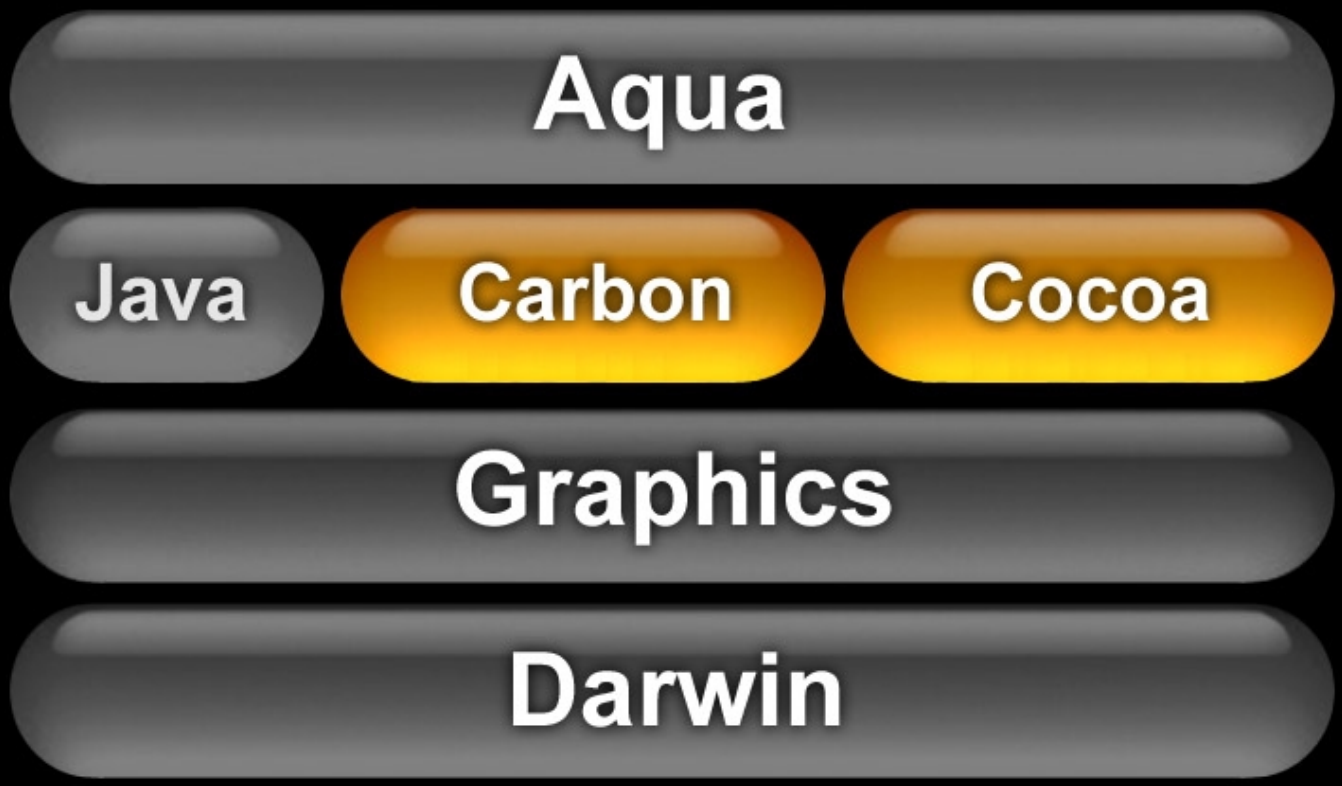
Darwin

What Is the Native Framework?

- Protected memory and preemptive multitasking
- Aqua
- Advanced application packaging
- Access to Quartz and all system frameworks
- Basis for future Apple innovations
- Basis for other frameworks and applications

Two Native Frameworks



Paving the Way for Killer Apps

Roadmap

Classic	Don’t even think about it
Cocoa Overview	Stay seated
Carbon: Start with Carbon Events	Hall 2 **Tues., 11:30am**
BSD and Darwin	In the past
Java Overview	Hall 2 **Tues., 9:00am**

WWDC

Worldwide Developers Conference 2001

WWDC

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